

Gennady Gorin, Ph.D.

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Biology is stochastic, and we observe it through the lens of noisy experimental methods. To fully understand regulation in living cells, we need to embrace the noise. I develop interpretable stochastic methods, an essential piece of the puzzle for single-cell multi-omics. I seek to use physical methods and organize interdisciplinary collaborations to analyze living systems, rigorously understand biology based on imperfect data, and use these insights to accelerate industrial research.

EDUCATION

Ph.D., California Institute of Technology (Lior Pachter Laboratory) 09/18–06/23
Academic laboratory developing end-to-end, physically informed bioinformatics methods
Developing physical theory and scalable stochastic methods for multi-modal single-cell sequencing data
Organizing cross-disciplinary, multi-institution collaborations in physics and machine learning
Building, training, and leading a subgroup dedicated to addressing gaps in current methods

Rice University, Summa Cum Laude, GPA 4.06 07/13–12/17
Bachelor of Science in Chemical and Biomolecular Engineering
Bachelor of Arts in Chemistry and Asian Studies

TECHNICAL SKILLS

Computation: Python (NumPy, SciPy, PyTorch, pandas), MATLAB, bash, CentOS administration
Data: bioinformatics (*kb*, *scanpy*, *velocity*, *Monod*) for multi-modal single-cell RNA sequencing technologies
Modeling: stochastic biophysical modeling, simulation, and inference; variational autoencoder design
Mathematics: stochastic processes, partial differential equations, approximation theory

COMMUNICATIONS SKILLS

Interpersonal: collaborating in a fast-paced pharma startup, building effective teams for solving problems
Written: scientific manuscripts, industry technical reports
Visual: data visualization, qualitative illustrations of mathematics and biophysics
Verbal: seminar presentations to specialist and non-technical audiences, scripted and unscripted theater
Languages: native English and Russian; elementary French and Mandarin

RESEARCH INTERNSHIPS

Data Sciences Co-op (Celsius Therapeutics) 06/22–08/22
Pharmaceutical startup leveraging transcriptomic analyses to develop therapeutics
Designed methods to decipher transcriptional mechanisms of disease states for drug discovery
Integrated analyses into the company's cloud computational pipeline for large patient datasets

Research Intern (Golding Laboratory, Baylor College of Medicine) 02/17–09/18
Academic laboratory synthesizing experiments and biophysics to decipher cell biology
Designed stochastic simulations and statistical analyses of microbial gene regulation
Organized a collaboration at the Xu Laboratory, Shanghai Jiao Tong University, to develop algorithms

NSF Research Experience for Undergraduates (Douglas Laboratory, Indiana University) 05/16–07/16
Academic laboratory developing virus-like particles as a biotechnology platform
Designed and constructed a reactor to investigate flow kinetics of encapsulated enzymes

Future Chemists International Summer Camp (Lu Laboratory, UST China) 06/15–07/15
Undergraduate-level research and cultural immersion program
Assisted a graduate student mentor in investigating novel palladium catalysts
Synthesized nanoparticles and monitored activity by gas chromatography

Research Assistant (Zubarev Laboratory, Rice University)	09/13–05/14
Academic laboratory studying nanoparticle applications	
Synthesized, functionalized, and analyzed gold nanoparticles	
Closely assisted a graduate student mentor in optimizing synthetic conditions	
Welch Summer Scholar Program (Smith Laboratory, UT Dallas)	06/12–07/12
High school-level chemistry research program across the University of Texas system	
Synthesized and characterized medical carbon fiber precursors	
Presented findings and program feedback to student participants and professors	

PUBLICATIONS – SCIENCE (ORCID RECORD)

- Gorin G**, Vastola JJ, Pachter L. Studying stochastic systems biology of the cell with single-cell genomics data. *bioRxiv*; 2023 May.
- Carilli M*, **Gorin G***, Choi Y, Chari T, Pachter L. Biophysical modeling with variational autoencoders for bimodal, single-cell RNA sequencing data. *bioRxiv*; 2023 May.
- Gorin G**, Pachter L. Distinguishing biophysical stochasticity from technical noise in single-cell RNA sequencing using *Monod*. *bioRxiv*; 2023 Apr.
- Gorin G**, Pachter L. The telegraph process is not a subordinator. *bioRxiv*; 2023 Jan.
- Gorin G**, Pachter L. Length Biases in Single-Cell RNA Sequencing of pre-mRNA. *Biophysical Reports*, 2023 Mar.
- Gorin G***, Vastola JJ*, Fang M, Pachter L. Interpretable and tractable models of transcriptional noise for the rational design of single-molecule quantification experiments. *Nature Communications*; 2022 Dec.
- Gorin G**, Yoshida S, Pachter L. Transient and delay chemical master equations. *bioRxiv*; 2022 Oct.
- Gorin G**, Fang M, Chari T, Pachter L. RNA velocity unraveled. *PLoS Computational Biology*; 2022 Sep.
- Gorin G***, Carilli M*, Chari T, Pachter L. Spectral neural approximations for models of transcriptional dynamics. *bioRxiv*; 2022 Jun.
- Gorin G**, Pachter L. Modeling bursty transcription and splicing with the chemical master equation. *Biophysical Journal*; 2022 Feb.
- Vastola JJ, **Gorin G**, Pachter L, Holmes WR. Analytic solution of chemical master equations involving gene switching. I: Representation theory and diagrammatic approach to exact solution. *arXiv*; 2021 Mar.
- Gorin G**, Pachter L. Intrinsic and extrinsic noise are distinguishable in a synthesis–export–degradation model of mRNA production. *bioRxiv*; 2020 Sep.
- Gorin G**, Pachter L. Special function methods for bursty models of transcription. *Physical Review E*; 2020 Aug.
- Gorin G**, Wang M, Golding I, Xu H. Stochastic simulation and statistical inference platform for visualization and estimation of transcriptional kinetics. *PLoS ONE*; 2020 Mar.
- Gorin G**, Svensson V, Pachter L. Protein velocity and acceleration from single-cell multiomics experiments. *Genome Biology*; 2020 Feb.

PUBLICATIONS – HUMANITIES

- Gorin G**. *Caltech Totem*; 2021 Jun. <https://caltechtotem.github.io/archives/issues/2021.pdf>
- Gorin G**. *Caltech Totem*; 2020 Jun. <https://caltechtotem.github.io/archives/issues/2020.pdf>
- Gorin G**. *Rice Asian Studies Review*. 2018 Apr; 2:11–17. https://rasr.rice.edu/issue2/RASR_VOLUME_2.pdf
- Gorin G**, Huang S-s S. *SSRN*; 2017 May. <https://doi.org/10.2139/ssrn.3476124>

WORK AND LEADERSHIP EXPERIENCE

Teaching Assistant (Division of Chemistry and Chemical Engineering, Caltech)	10–12/19, 1–3/21
Graded graduate-level chemical engineering thermodynamics courses	
Technical Intern (Houston Asian American Archive, Rice University)	09/15–05/17
Researched and proposed solutions for an oral history archive’s website and storage	
Created a video for university’s celebration of Asian alumni attended by nearly 200 people	

Operations Director/Secretary (KTRU Rice Radio, Rice University)	09/13–08/18
Managed PSA and promotion rotation of an FM college radio station	
Ensured compliance with FCC regulations	
Developed budgetary documentation and secured grant funds up to \$25,000	
Hosted a musique concrète radio show	
Teaching Assistant (Department of Bioengineering, Rice University)	01/17–05/17
Developed rubrics for and graded an upper-level bioengineering numerical methods course	
Teaching Assistant (Department of Chemistry, Rice University)	09/14–11/14
Graded a sophomore-level Organic Chemistry course	

SOFTWARE

Carilli, M; Choi, Y; Gorin, G. <i>biVI</i> : physically motivated variational autoencoder (Python).	08/21
https://github.com/pachterlab/CGCCP_2023	
Gorin, G. <i>Monod</i> : mechanistic transcriptional inference from sequencing data (Python).	08/21
https://pypi.org/project/monod/	
Gorin, G. Generation, simulation, and solution of Markovian splicing processes (Python).	07/21
https://github.com/pachterlab/GP_2021_2	
Gorin, G. Exact simulation of hybrid stochastic systems (Python/MATLAB/Octave).	02/21
https://github.com/pachterlab/GVFP_2021	
Gorin, G. protaccel: trajectory inference from protein/RNA datasets (Python).	
https://pypi.org/project/protaccel/	09/19
Gorin, G. Stochastic simulation for visualization and estimation of transcriptional kinetics (MATLAB).	09/19
https://data.caltech.edu/records/1287	

CONFERENCES, PRESENTATIONS, AND PROFESSIONAL DEVELOPMENT

American Physical Society March Meeting talk	03/23
“Interpretable and tractable probabilistic models for single-cell RNA sequencing”	
Theoretical Biophysics podcast episode	03/22
“Modeling bursty transcription”	
Chen Neuroscience Research Building Weekly Seminar Series talk	03/22
“Parameterizing models of stochastic transcriptional dynamics with snapshot scRNA-seq data”	
Cold Spring Harbor Laboratory Systems Biology 2022 talk	03/22
“Parameterizing models of stochastic transcriptional dynamics with snapshot scRNA-seq data”	
Caltech Chemistry and Chemical Engineering Seminar Day presentation	10/21
“How should we think about cells?”	
Gordon Research Conference on Stochastic Physics in Biology 2021 poster	10/21
“Markov models of RNA transcription and sequencing”	
Society for Industrial and Applied Mathematics Dynamical Systems 2021 poster	05/21
“Modular and interpretable models of transcriptional noise and splicing”	
Biophysical Society 2021 Annual Meeting poster	02/21
“Analysis of Length Biases in Single-Cell RNA Sequencing of Unspliced mRNA by Markov Modeling”	
Cold Spring Harbor Laboratory Genome Informatics 2020 poster	09/20
“Analysis of Length Biases in Single-Cell RNA Sequencing of Unspliced mRNA by Markov Modeling”	
Biophysical Society 2020 Annual Meeting poster	02/20
“Semi-Analytical Methods for RNA Burst Models”	
Caltech Graduate Research Spotlight poster	05/19
“RNA velocity and protein acceleration from multimodal single-cell experiments”	

q-bio 2018 Conference poster	06/18
"Simulating and Fitting Stochastic Models of RNA Transcription via the Gillespie Algorithm"	
q-bio 2018 Summer School	06/18
Rice Engineering Design Showcase	04/17
"Cow Manure to Methanol by Hydrothermal Gasification"	
Akers Senior Design Competition	04/17
"Cow Manure to Methanol by Hydrothermal Gasification"	
Indiana University Materials Symposium poster	07/16
"A Flow Reactor Using Catalytic Bulk-Assembled Virus-Like Particles"	

PERFORMANCE

IMPLiCIT, improvised theater troupe at the California Institute of Technology	10/18–03/22
EXPLiCIT, theater group at the California Institute of Technology	07/21–08/21
Lead (Felix) in <i>Humble Boy</i>	
Comedy al Dente: <i>Commedia dell'arte</i> revival troupe	8/19–11/19

SCHOLARSHIPS AND HONORS

Dwane Rivers Memorial Scholarship in Chemical Engineering	09/17
Undergraduate Asian Studies Internship Award for summer internship in Asia	05/17
Louis J. Walsh Scholarship in Engineering	16–17
T.W. Moore Scholarship, awarded to 5 juniors with highest GPAs in department	16–17
Rice University President's Honor Roll, 6 out of 8 semesters at Rice University	13–17

AWARDS

Caltech Graduate Research Spotlight Second Prize Winner (out of 26 presenters)	05/19
Rice Engineers Week Student Competition Prize Winner (out of >20 teams)	02/14
Rice Center for Engineering Leadership Liftoff Winner	09/13

SOCIETIES AND PROFESSIONAL ACTIVITIES

Manuscript reviewer for BPS and SIAM society journals	
American Physical Society: professional society, member since 2022	
Biophysical Society: professional society, member since 2019	
Phi Beta Kappa: liberal arts and sciences honor society, member since 2018	
Tau Beta Pi: engineering honor society, member since 2016	
American Institute of Chemical Engineers: professional society, member since 2013	